

Application No. 10/707,197
Docket No. 128693
Amendment dated January 21, 2005
Reply to Office Action of October 22, 2004

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

Claim 1 (currently amended): A thermal barrier coating on a surface of a component, the thermal barrier coating having an interior region formed of a ceramic material so as to have a lower thermal conductivity than zirconia partially stabilized by about seven weight percent yttria, and an outer surface region on and contacting the interior region and formed of a ceramic material, ~~the interior region constituting more than half of the thickness of the thermal barrier coating and the outer surface region constituting less than half of the thickness of the thermal barrier coating,~~ the thermal barrier coating having a columnar microstructure whereby the interior region and the outer surface region comprise columnar grains ~~columns~~ of their ceramic materials, the grains of the interior region and the outer surface region being oriented substantially normal to the surface of the component, at least a portion of the columnar microstructure comprising feathery grains, the grains ~~columns~~ of the outer surface region being denser, more columnar, and more closely spaced than the grains ~~columns~~ of the interior region, the outer surface region being more erosion and impact resistant

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than the interior region at least in part as a result of the grains ~~columns~~ thereof being more closely spaced than the grains ~~columns~~ of the interior region.

Claim 2 (original): A thermal barrier coating according to claim 1, wherein the ceramic materials of the interior region and the outer surface region have the same composition.

Claim 3 (original): A thermal barrier coating according to claim 1, wherein the thermal barrier coating consists essentially of zirconia and at least one of ytterbia, yttria, neodymia, lanthana, hafnia, tantalum, gadolinia, erbia, and dysprosia.

Claim 4 (original): A thermal barrier coating according to claim 3, wherein the ceramic materials of the interior region and the outer surface region have the same composition.

Claim 5 (original): A thermal barrier coating according to claim 1, wherein the thermal barrier coating consists essentially of zirconia, yttria, and at least one of ytterbia, neodymia, lanthana, hafnia, tantalum, gadolinia, erbia, and dysprosia.

Claim 6 (original): A thermal barrier coating according to claim 5, wherein

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the ceramic materials of the interior region and the outer surface region have the same composition.

Claim 7 (original): A thermal barrier coating according to claim 1, wherein the ceramic materials of the interior region and the outer surface region do not have the same composition.

Claim 8 (original): A thermal barrier coating according to claim 7, wherein the outer surface region contains at least one of nickel, titanium, chromium, and oxides thereof, and the interior region is substantially free of nickel, titanium, chromium, and oxides thereof.

Claim 9 (original): A thermal barrier coating according to claim 1, wherein the interior region of the thermal barrier coating consists essentially of zirconia and at least one of ytterbia, yttria, neodymia, lanthana, hafnia, tantalum, gadolinia, erbia, and dysprosia, and wherein the outer surface region consists essentially of zirconia partially stabilized by yttria, whereby the ceramic materials of the interior region and the outer surface region do not have the same composition.

Claim 10 (original): A thermal barrier coating according to claim 9, wherein

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the outer surface region consists essentially of zirconia stabilized by about four to about eight weight percent yttria.

Claim 11 (original): A thermal barrier coating according to claim 1, wherein the interior region of the thermal barrier coating consists essentially of zirconia, yttria, and at least one of ytterbia, neodymia, lanthana, hafnia, tantalum, gadolinia, erbia, and dysprosia, and wherein the outer surface region consists essentially of zirconia partially stabilized by yttria, whereby the ceramic materials of the interior region and the outer surface region do not have the same composition.

Claim 12 (original): A thermal barrier coating according to claim 11, wherein the outer surface region consists essentially of zirconia partially stabilized by about four to about eight weight percent yttria.

Claim 13 (original): A thermal barrier coating according to claim 1, wherein the outer surface region has a hardness of at least 6 GPa as measured by the Vickers pyramid with a fifty-gram load.

Claim 14 (original): A thermal barrier coating according to claim 1, wherein the interior region and the outer surface region are discrete layers separated by a distinct

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interface.

Claim 15 (original): A thermal barrier coating according to claim 1, wherein the interior region and the outer surface region are not discrete layers and are not separated by a distinct interface.

Claim 16 (currently amended): A thermal barrier coating on a surface of a gas turbine engine component, the thermal barrier coating having an interior region and an outer surface region on and contacting the interior region, the interior region and the outer surface region being discrete ceramic layers separated by a distinct interface, the interior region consisting essentially of zirconia and at least one of ytterbia, yttria, neodymia, lanthana, hafnia, tantala, gadolinia, erbia, and dysprosia, ~~the outer surface region having a thickness of about 10 to about 125 micrometers and the balance of the thickness of the thermal barrier coating being defined by the interior region and having a thickness greater than the outer surface region,~~ the thermal barrier coating having a columnar microstructure whereby the interior region and the outer surface region comprise columnar grains, at least a portion of the columnar microstructure comprising feathery grains, ~~the grains~~ columns, ~~the columns~~ of the outer surface region being denser, more columnar and more closely spaced than the grains ~~columns~~ of the interior region, ~~the outer surface region having a hardness of at least 6 GPa as measured by the~~

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~~Vickers pyramid with a fifty-gram load,~~ the outer surface region being more erosion and impact resistant than the interior region at least in part as a result of the grains ~~columns~~ thereof being more closely spaced than the grains ~~columns~~ of the interior region.

Claim 17 (original): A thermal barrier coating according to claim 16, wherein the interior region and the outer surface region have the same composition.

Claim 18 (original): A thermal barrier coating according to claim 17, wherein the composition of the interior region and the outer surface region is zirconia containing about 1 to about 65 weight percent of at least one additive oxide chosen from the group consisting of ytterbia, yttria, neodymia, lanthana, hafnia, tantala, gadolinia, erbia, and dysprosia.

Claim 19 (original): A thermal barrier coating according to claim 16, wherein the interior region and the outer surface region do not have the same composition.

Claim 20 (original): A thermal barrier coating according to claim 19, wherein the outer surface region consists essentially of zirconia partially stabilized by

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about 4 to about 8 weight percent yttria.

Claim 21 (new): A thermal barrier coating according to claim 1, wherein the interior region and the outer surface region comprise feathery grains, the grains of the interior region are more feathery than the grains of the outer surface region, and the feathery grains of the outer surface region are denser and less porous than the feathery grains of the interior region.

Claim 22 (new): A thermal barrier coating according to claim 1, wherein the outer surface region does not contain feathery grains.

Claim 23 (new): A thermal barrier coating according to claim 16, wherein the grains of the interior region and the outer surface region are oriented substantially normal to the surface of the component.

Claim 24 (new): A thermal barrier coating according to claim 16, wherein the interior region and the outer surface region comprise feathery grains, the grains of the interior region are more feathery than the grains of the outer surface region, and the feathery grains of the outer surface region are denser and less porous than the feathery grains of the interior region.

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Claim 25 (new): A thermal barrier coating according to claim 16, wherein the outer surface region does not contain feathery grains.

Claim 26 (new): A thermal barrier coating on a surface of a component, the thermal barrier coating having an interior region formed of a ceramic material so as to have a lower thermal conductivity than zirconia partially stabilized by about seven weight percent yttria, and an outer surface region on and contacting the interior region and formed of a ceramic material that has a different composition than the ceramic materials of the interior region, the interior region constituting more than half of the thickness of the thermal barrier coating and the outer surface region constituting less than half of the thickness of the thermal barrier coating, the thermal barrier coating having a columnar microstructure whereby the interior region and the outer surface region comprise columns of their ceramic materials, the columns of the outer surface region being more closely spaced than the columns of the interior region, the outer surface region being more erosion and impact resistant than the interior region at least in part as a result of the columns thereof being more closely spaced than the columns of the interior region.